Fisheries and Oceans Canada / Pêches et Océans Canada
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National Capital Region
Canadian Science Advisory Secretariat
Science Advisory Report 2006/023

A HARVEST STRATEGY COMPLIANT WITH THE PRECAUTIONARY APPROACH

Figure 1: Fisheries and Oceans Canada (DFO) six administrative regions. The dashed line indicates Canada's EEZ.

Context

Canada has been a strong proponent of the management principles outlined in the United Nations Fish Stock Agreement (UNFSA - also commonly referred to as UNFA) that it ratified in the fall of 1999. The Agreement came into effect in December 2001 and amongst other things, it requires countries to use the Precautionary Approach (PA) in the management of fisheries. At about the same time, the Privy Council Office (PCO) of the Government of Canada developed the Federal Framework for the precautionary approach to ensure that precaution would be applied consistently across disciplines in the government. The framework became government policy in 2003. Over the last few years, there have been some initiatives in Canada to define the precautionary approach in a fisheries context, to identify benchmarks that would be consistent with the approach and to apply it in fisheries management. As risk based decision-making frameworks for Canadian fisheries are being developed, numerous meetings of the Science Sector National Working Group on the Precautionary Approach have been held. At its October 2005 meeting, the Working Group described the minimal requirements for harvesting strategies in these fisheries management frameworks to be compliant with the Precautionary Approach.

SUMMARY

- The Precautionary Approach framework prescribes three stock status zones.
- The *Limit reference point* is the stock level below which productivity is sufficiently impaired to cause serious harm to the resource but above the level where the risk of extinction becomes a concern. The zone below the Limit reference point is called the *Critical* zone.

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- The *Upper stock reference point* is the stock level threshold below which the removal rate is reduced. The stock status zone above the Limit reference point but below the Upper stock reference is called the *Cautious* zone. The stock status zone above the Upper stock reference is called the *Healthy* zone.
- *The Removal reference* is the maximum acceptable removal rate.
- The removal rate is the ratio of all human induced removals and total exploitable stock size.
- In the *Healthy* zone, the removal rate should not exceed the Removal reference.
- In the *Cautious* zone, fisheries management actions should promote stock rebuilding towards the Healthy zone. The removal rate should not exceed the Removal reference.
- In the *Critical* zone, fishery management actions must promote stock growth. Removals by all human sources must be kept to the lowest possible level.

INTRODUCTION

The Precautionary Approach is a general philosophy to managing threats of serious or irreversible harm where there is scientific uncertainty. It can be applied to all kinds of situations from precautions to avoid the spread of contagious diseases, to air traffic control to pollution prevention. Good risk management compels us to use caution and to take uncertainty into account when making decisions. The application of precaution requires increased risk avoidance where there is risk of serious harm and uncertainty is great. These conditions often apply in fisheries; therefore precaution should be incorporated in fisheries management.

The Precautionary Approach is applicable to all fisheries management strategies. This report only considers application of the Precautionary Approach to the harvest strategy, one of many management strategies aimed at meeting conservation objectives. It outlines the minimal elements that a harvest strategy for fisheries on exploited species must have to comply with the Precautionary Approach.

ASSESSMENT

Background

A harvest strategy should be incorporated into fishery management plans and the implementation of the strategy should be evaluated on a regular basis. The harvest strategy aims to keep the removal rate moderate when the stock status is healthy, promote rebuilding when stock status is low and ensure a low risk of serious or irreversible harm. The removal rate is the ratio of all human induced removals and total exploitable stock size. The harvest strategy applies to any exploited resource, regardless of the nature of the harvesting, e.g. commercial, recreational, subsistence, etc., and the removal rate pertains to all human induced mortality, including for example, by-catch, discards, incidental mortality, or deaths caused by other human activities. The use of precaution is articulated in various DFO fisheries policy documents such as the Policy Framework for the Management of Fisheries on Canada's Atlantic Coast (2004) and the Policy Framework for the Conservation of Wild Pacific Salmon (2004). The proposed framework in this document is considered to satisfy the intent of both the Federal Framework for the Precautionary Approach developed by the Privy Council Office of Canada and the United Nations Fish Stock Agreement (UNFSA – also commonly referred to as

UNFA) that resulted from the United Nations Conference on Straddling and Highly Migratory Fish Stocks.

Population dynamics theory suggests that fish populations that are sufficiently productive to support a fishery should be harvested with a constant moderate removal rate in order to conserve productivity. Such a policy may not perform satisfactorily in practice however, because the rate of recovery for depleted populations may be slow. As well, it affords little room for errors of assessment or environmentally driven fluctuations of productivity, particularly if these occur at the same time. Strategies that reduce the removal rate when the stock status is low perform better, in relation to both long term yield and conservation of the resource.

Such a harvest strategy could be sufficient if there was confidence that the number of recruits produced per spawner does not decrease at low biomass, the opposite of a condition referred to as reproductive depensation. Convincing evidence for reproductive depensation is difficult to find. However, studies have suggested that reproductive depensation would generally be difficult to detect even if it did occur. With reproductive depensation, recovery from low biomass could be very protracted or perhaps not even possible and could lead to extirpation. In recognition that the dynamics of populations at very low stock levels are not well understood and that any removals may increase the risk of further decline and impede recovery, the Canadian policy on Precautionary Approach calls for the identification of conditions that represent serious or irreversible harm. Accordingly, a lower stock status reference point is required giving rise to a framework with three stock status zones.

In the absence of convincing evidence for a depensatory response in the recruitment or production function, there does not appear to be a completely non-arbitrary method of determining a specific point which indicates the occurrence of serious harm to the resource. Therefore it is inevitable that there will be some subjectivity in the determination of this limit reference point. Various practical, but arbitrary, proxies have been put forth as candidates for a biomass limit reference point. In each application, experience, judgment and knowledge of stock specific circumstances are important considerations in setting the technical basis for the determination of reference points.

The biomass limit reference point is not a precise switch for turning off or turning on exploitation. However, population dynamics are not understood when biomass is below the limit, and the risks are great if depensation occurs. Under high uncertainty and risk, the Precautionary Approach prescribes extra caution and therefore, keeping exploitation at the lowest practicable level is advisable. When the stock is below the limit reference point, emphasis should be placed on taking appropriate management actions to promote an increase in biomass.

A Harvest Strategy Compliant with the Precautionary Approach

General framework

The harvest strategy compliant with the Precautionary Approach includes a Removal Reference for three stock status zones delineated by a Limit Reference Point and an Upper Stock Reference (Figure 2). Stock status is usually represented by spawning stock biomass or a suitable proxy.

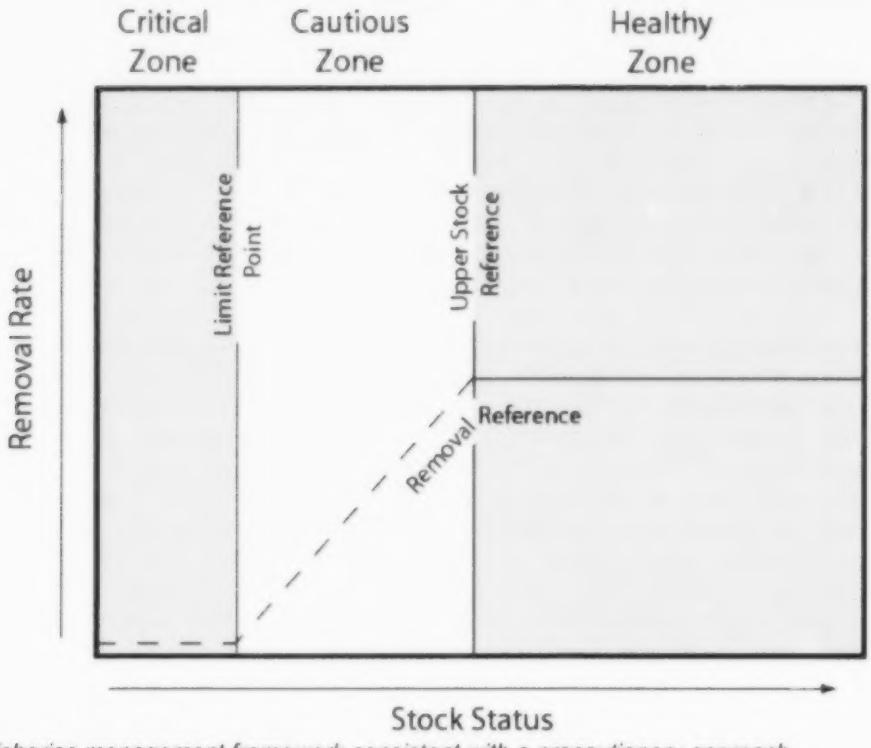

Figure 2: Fisheries management framework consistent with a precautionary approach.

Definitions

The *Upper stock reference point* is the stock level threshold below which the removal rate is reduced. As such it applies to exploited populations. This reference point is determined by productivity objectives for the fishery. These objectives will vary among species and fisheries and include biological, social and economic factors . The stock status zone above the Upper stock reference is called the *Healthy* zone.

The *Limit reference point* is the stock level below which productivity is sufficiently impaired to cause serious harm but above the level where the risk of extinction becomes a concern. In this context, serious harm could be due to over-fishing, other human induced mortality, or changes in population dynamics not related to fishing. The stock status zone above the Limit reference point but below the Upper stock reference is called the *Cautious* zone. The zone below the Limit reference point is called the *Critical* zone.

The Removal reference is the maximum acceptable removal rate. The removal rate is the ratio of all human induced removals and total exploitable stock size. To comply with the UNFSA, it must be less than or equal to the removal rate associated with maximum sustainable yield. The Removal Reference includes all human-induced mortality.

The Stock references and Removal reference are defined for "normal" conditions and may be adjusted to reflect changes in stock dynamics. The reference points will be determined by the best available science.

Harvest strategy

Harvest strategies are typically implemented by regulating the removal rate either by controlling total catch or by controlling fishing effort. The Science Sector National Working Group on the Precautionary Approach concluded that to be compliant with the Precautionary Approach, fishery management plans should include harvest strategies that incorporate a Limit Reference Point, an Upper Stock Reference and a Removal Reference. Further, the management decisions must respect the indicated actions in each of the stock zones as follows:

- In the *Healthy* zone, the stock status is considered to be good. In this zone, the removal rate should not exceed the Removal reference.
- In the *Cautious* zone, fisheries management actions should promote stock rebuilding towards the Healthy zone. The removal rate should not exceed the Removal reference. The Removal reference should progressively decrease as the stock level approaches the Critical zone. For simplicity, Figure 2 shows a proportional reduction of removal rate with respect to stock level as a dashed line. Any progressively decreasing removal rate in the Cautious zone is permissible.
- In the *Critical* zone, the status of the stock has declined to such a low level that it is considered to be in a precarious state. In this zone, fishery management actions must promote stock growth. Removals by all human sources must be kept to the lowest possible level.

CONCLUSIONS AND ADVICE

In order to comply with Canadian policy statements and international fisheries agreements, harvest strategies for fisheries management need to adhere to the minimal requirements described above. These elements should be included in fisheries management plans and used to guide decisions for all species regulated by an exploitation policy. For many stocks, reference points for harvest strategies compliant with the application of the Precautionary Approach have already been developed. Reference points for other stocks should be developed so that implementation of the Precautionary Approach for these stocks can proceed. The application of harvest strategies compliant with the Precautionary Approach will require the development of risk-based decision frameworks for each species stock by fishery management staff.

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